



## VARIABLE WORK HOURS

### I. DESCRIPTION

Work hour policies established by employers govern when employees travel to and from work. The policies influence not only the volume of employees traveling during peak traffic periods, but employee propensity to consider transit, carpooling and other alternatives to driving alone. Consequently, work hour management is an important component of travel demand management.

There are three types of variable work hours with potential application as demand management tools:

- *Staggered work hours*
- *Compressed work weeks*
- *Flextime*

Staggered hours are staged start work times set by employers. For example, employee start times might be set at 15 minute increments across the morning. The primary influence of this strategy is to spread peak traffic.

Compressed work weeks allow employees to work more hours in fewer days than the usual eight hour per day schedule. One common option is the "4/10." Employees work 10 hour days over four days. The influence of this approach potentially is twofold: reduce vehicle miles of travel across the work week and encourage employees to arrive and/or depart outside normal daily peak periods.

Flextime allows employees to set their own arrival and departure time within a band of time. The employee is required to arrive within a two or three hour band and leave eight hours later. This strategy potentially influences travel in several ways. In congested areas, it may encourage employees to avoid most congested times, thereby spreading peak traffic. And where work hour

differences within a company are a barrier to ridesharing, it can encourage rideshare candidates to coordinate arrivals and departures where they previously could not.

### II. EFFECTS

The first important effect of variable work hours is on when employees travel. One of the most important potential effects is reducing the volume of peak traffic.

#### Timing of Trips

*Compressed Work Week:* A carefully controlled experiment among federal employees in Denver showed this strategy can both flatten the peak arrival volume and shift when the peak occurs. Participants arrived one hour earlier on average than before the program, and departed about one hour later. The maximum percentage of total arrivals in a half hour period was reduced from 56 to 42 percent. The maximum half hour percentage of total departures also was flattened from 47 to 34 percent.

Of course, the influence of such a shift depends on how many employees participate in the program. In this test case, the participation within federal agencies exposed to the program was 65 percent. About 9,000 federal employees in 42 agencies participated. The most popular forms of compressed work week were the four day work week with ten hour days and a five/four-nine plan.<sup>1</sup>

*Flextime:* This strategy appears to have a positive effect on time of arrival. For example, one test in San Francisco showed at least half of the participants arriving to work 30 or more minutes earlier than before flextime. Many arrived at work at 7:00 a.m. By traveling before the main peak period, those arriving by car or carpool saved on average of nine minutes each trip, or an hour and a half for two-way commuting each week. Over 60 percent reported they encountered "much less congestion" on their way to work. In the test, about 6,000 employees participated in the flextime experiment across 23 companies.<sup>2</sup> At Bishop Ranch in California, flextime policies appear to be successful in shifting employee arrival times to earlier periods. A survey of 14,800



employees between 1988 and 1990 showed the percent of employees starting work before 7:00 a.m. increased from eight to 17 percent, and the percent starting work after 9:00 a.m. increased from one to 9 percent. Departure peaking also has been reduced. The percentage of workers leaving before 4:00 p.m. increased from 12 to 17 percent. The employer flextime programs were instituted as part of a broad demand management program for the area, as well as a local trip reduction ordinance encouraging reduction of peak hour vehicle trips.<sup>3</sup>

*Staggered Hours:* One recent evaluation of staggered hours in downtown Honolulu found statistically significant reductions in peak period travel time due to spreading of the peak. Travel time was measured from a "floating car," meaning reductions in actual travel time were measured along specific commute routes. Reductions were up to 18 percent depending on the route, or up to 7 minutes in the commute. The study makes clear there are winners and losers under staggered hours. Those making early departures saved the most in travel time. Those shifting to a later arrival time actually lost travel time, because they moved into the new peak period. About 3,500 employees of the 7,100 employees in the Civic Center participated in the project. Participation in the project was mandatory for all public employees, though private sector participation was voluntary. About eighteen major corporations participated. Overall, about 11,000 employees participated, or about 18 percent of the downtown work force.<sup>4</sup>

### Mode of Travel and Non-Work Trips

The second important effect of variable work hours is on mode of travel and on the volume of non-work trips. Looking at non-work trips first, the issue of concern is whether or not non-work trips may increase under compressed work weeks. It is conceivable that employees working four day work weeks may make more non-work trips with an extra day off from work. If they do, the net effects on vehicle miles of travel (VMT) and air quality may not be favorable. The other important issue is travel mode. It is possible variable work hour programs might break up carpools, for example, or make transit use more difficult depending on carpool arrangements and transit schedules prior and after the work hour program.

Evidence on both issues is scanty, but some evaluations address the subject:

*Compressed Work Weeks:* In the case of federal employees in Denver, evaluations suggest the strategy had no adverse effects on ridesharing and transit. Denver showed VMT reductions for work and non-work travel among participating employees of 15 percent, with no adverse impacts on ridesharing or transit use. Given the large number of employees participating, this reduction translates into a fairly large reduction in VMT for Denver federal employees taken as a whole: 5.6 percent. Another recent study of compressed work weeks suggests it was associated with a decline in solo driving, from 82 percent to 77 percent.<sup>5</sup>

*Flextime:* Some studies show flextime is associated with increased ridesharing, but not in other cases. On the side of favorable results from flextime, RIDES, the regional rideshare agency in the San Francisco Bay Area, has found the placement rate among its rideshare applicants on flextime to be 30 percent compared to 16 percent for applicants not on flextime.<sup>6</sup> Another dated study suggests only about nine percent of workers changed modes due to flextime, and among these, "there was a small net changes in favor of ridesharing and public transport."<sup>7</sup> On the side suggesting unfavorable results from flextime are findings from Pleasanton, California. Employees surveys in this suburban city suggest only 7.6 percent of Pleasanton workers under flextime used ridesharing, compared to 11.4 percent of the entire Pleasanton work force.<sup>8</sup> Another study of flextime introduced at the Tennessee Valley Authority suggests about two percent loss in vanpool ridership due to the flextime program. Vanpoolers adjusted their schedules to meet rider preferences for earlier arrival times. However, bus ridership fell considerably (21 percent) because bus schedules were not changed in a similar way. The case shows the importance of coordinating alternative mode services with work hour programs and employee preferences for arrival and departure times.<sup>9</sup> Another study suggests both the importance of coordinating express bus service with variable work hours, and a method for doing so in the case of staggered hours.<sup>10</sup>



### Other Effects

Absenteeism, tardiness and turnover may be reduced by variable work hour programs in settings where workers need and want more flexibility in their schedules. For example, one company found flextime reduced sick time and personal leave an average of 3.5 days per year per employee and increased productivity by three percent.<sup>11</sup>

### In Sum

The examples suggest variation in the expected traffic impacts of variable work hours. Much depends on the type of work hour strategy, whether mode choice is affected as well as time of travel, and the nature of the local congestion problem. The possible effects from the case studies are summarized here:

- The most probable effect of all the variable work hours are earlier arrival and departure among participants, with a flattening in peak period traffic. The magnitude of the peak flattening may be quite substantial. The results of the Denver experiment with compressed work weeks showed a 14 percent decline in the maximum percentage of total arrivals in a half hour period, and a 13 percent decline in the maximum half hour percentage of total departures.
- Compressed work weeks may reduce vehicle miles of travel, depending on number of commute days and mode of travel. Compressed work weeks appear to reduce not just work trips but total trips. The case study suggests VMT reductions of 15 percent. The reason for the VMT reduction is simply the fact that commuters work fewer days per month, and non-work trips do not offset the reductions in work trips.
- For flextime and staggered work hours, effects on VMT are not so clear cut. All depends on whether or not mode of travel is affected. The evidence suggests flextime may encourage transit use where service is sufficiently frequent and available before peak periods when flextime participants prefer to travel. Good transit service is probably the reason

for the boost in transit ridership under the San Francisco flextime experiment. However, where flextime is introduced without good transit service off peak, or where the service is not adjusted to allow for commuters wanting to travel in earlier times, then transit ridership may well decline. The TVA case study provides one such instance.

## III. IMPLEMENTATION

### Applicability

Variable work hours are more or less applicable in work settings depending on the nature of the work force:

- Flextime: most applicable to offices and among administrative and information workers; less application to shift workers and assembly lines, or where there is need for continuous communication between workers.
- Compressed work weeks: applicable to office and administrative functions, especially governmental agencies; perhaps most applicable to line and piece manufacturing processes.
- Staggered hours: applicable to offices and piece manufacturing, but not applicable to line manufacturing where workers are highly interdependent.

Variable work hours can be expected to work best where a large number of employees are affected, and where the associated traffic is concentrated rather than spread out. For example, flextime implemented by a large industry or government agency may considerably reduce traffic on streets and highways in the immediate vicinity of the agency or plant. Likewise, peak loading on transit facilities might be reduced.

Variable work hours do not apply only to urban areas. In fact, one of the more successful examples of employers shifting employee arrival times is in Pleasanton, California, a suburb in the San Francisco Bay area. Here, many large and small employers have shifted employee arrival times in response to a City trip



reduction ordinance aimed at reducing peak period travel.<sup>12</sup>

### To Require Or Not Require ...

As programs in Hawaii, Denver and San Francisco suggest, aggressive campaigns initiated by the public and private sector in employment centers may be sufficient to attract considerable participation in variable work hours. However, variable work hours also can be encouraged through trip reduction ordinances, air quality regulations and other policies. These regulations can require employers to consider variable work hours as part of demand management programs, and to implement work hour changes where feasible and beneficial.

Caution is needed in designing mandatory variable work hour programs. Employees obliged to shift to a later arrival time under the staggered work hour program may experienced greater travel time compared to their previous situation, leading to considerable resentment and dissatisfaction. In the experiment with Hawaii workers referenced above, almost all private sector managers reported the same or better level of employee morale during the project under their voluntary program. In contrast, City-county managers reported worse or much worse employee morale during their mandatory project. Probably the best



approach is to require agencies and departments to devise the best work hour system for their particular functions and public interaction needs.

Furthermore, employees probably will prefer compressed work weeks and flextime to staggered work hours.

### Planning and Policy Considerations

Implementation of variable work hour policies and programs involves an array of private and public sector parties. Company management and corporate policies bear on work hours. Employees influence work hours through their unions. Localities may encourage variable work hours through local demand management ordinances affecting employers. Likewise, states and air

quality districts may require attention to variable work hours in local regulations and rules. Federal labor legislation (and sometimes state legislation) sets certain parameters within which any work hour program, variable or not, must operate.

Careful planning is needed to start a variable work hour program. Steps include assessing positions of management in various departments, possible conflicts with the need to interact with clients and customers, and needed changes in company policies. It also is important to estimate need for changes in security coverage and settings in building heating, cooling and lighting. Procedures and costs associated with these changes need to be assessed and compared with benefits in vehicle trip reduction. Some important steps in the implementation of variable work hours within participating companies and organizations include:

- Meetings with each level in an organization to spell out the proposal, gain feedback, assess feasibility and modify plans
- Modification of work hour policies and union agreements as needed to accommodate the designed program. Some key labor issues include the definition of overtime in a flexible schedule, which employees will and will not qualify for variable work hour consideration, method of recording and tracking hours worked.
- Development of supervisor information guides with individual counseling sessions. For example, how to insure telephone coverage (rotating coverage by secretaries); how to insure check abuse (remove flextime privilege for offenders).
- Implementation of a pilot program for six months with assessment survey to evaluate worker and supervisor reactions. The survey should address issues of commute, personal control over time, communications with supervisors, morale, absenteeism, turnover, work flow, service quality and customer perceptions.

Another important planning point involves coordination with transit and carpool services. Transit, vanpool and carpool schedules may need to be changed



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in light of new employee arrival and departure times. In some cases, new carpools and vanpools may be necessary to replace obsolete rideshare arrangements.

Variable work hours may involve some implementation hurdles. Sometimes labor union agreements will restrict the hours employees work. Any change may require formal meeting and negotiating. Management may resist flextime believing it reduces flexibility to schedule meetings or inhibits responsiveness to clients and customers. One study of 4-day workweeks suggests managers believe communication between departments and between agencies or firms may be adversely effected.<sup>13</sup> Another survey of State Departments of Transportation found employees generally favored alternative work hours, but management expressed concern about employee supervision.<sup>14</sup>

State policies and legislation may need revision to encourage variable work hours. Many states have fair labor acts and standards which limit the maximum number of hours worked without compensation for overtime. Sometimes, the legislation requires work in excess of 40 hours per week to be compensated at some multiple of regular hourly rates. While this is not a barrier to flextime, it could present implementation issues under compressed work week programs allowing more than 40 work hours in certain weeks. Less common is legislation setting maximum requirements on a daily rather than weekly basis. State labor legislation of this kind would have to be changed to allow any form of compressed work week.

### Cost Benefit Considerations



The literature does not document the costs of variable work hour programs. Main cost items include labor time to plan and set up the program, and possible increased utility and security costs associated with

opening an office earlier and keeping it open later than usual.

While the literature does not quantify costs, one source suggests they are minor in comparison to potential benefits in reduced trip making and increased

productivity. Benefits included increases in employee work hours, reduced tardiness and reduced work hours missed due to inclement weather.<sup>15</sup> Another study of firms in Lower Manhattan suggested 15 percent involved in staggered work hours reported communications problems, but said these costs were balanced by other efficiency gains in increased employee punctuality.<sup>16</sup>

To illustrate the possible cost effectiveness of a variable work hour program, suppose a variable work hour program is implemented in a medium size company of 2,000 employees. Suppose further the program increases some information and transaction costs within the firm or between the firm and other businesses, but the cost are are balanced by reductions in employee tardiness and gains in productivity, as evidence above suggests may be the case. Consequently, the net program costs are those incurred in setting up the program and operating building facilities for longer hours.

An estimate of these costs can be made. Assuming a mid-level manager works 40 percent time over one year to create the program, for an initial investment of \$25,000. Assume other personnel costs for meetings and policy changes incur about the same costs, for a total investment of \$50,000 in round numbers. Assume extra utility and security costs of \$1,500 per month or \$18,000 per year. Assume the company amortizes these costs over thirty years and uses a 10 percent discount rate. Then present value of the total investment is \$219,684.

In terms of effectiveness and savings, all depends on what proportion of employees begin variable work hours and their before and after driving habits. In the Denver case cited, 65 percent of employees exposed to the program changed work hours, and among this group the total VMT reduction was 15 percent. The high participation rate is perhaps unique to government employees. Suppose only 15 percent of employees in the example firm begin the variable work hour program and reduce their work trip VMT by seven percent, about half of the reduction in VMT in the Denver experiment where both work and non-work trip reductions were counted. Thus, among the 2,000 employees in the example firm, 300 participate and reduce their VMT by seven percent.

With this VMT reduction, we can estimate trip reduction. Presuming there are about 90 vehicle trips per



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100 employees (allowing for some use of transit, carpooling, walking), then the 300 employees make 270 vehicle trips to work. If work trips are 20 miles in length, the 300 employees generate 5,400 vehicle miles and a seven percent reduction is a savings of 378 miles, or the equivalent of 19 vehicle work trips.

Finally, from trip reduction, we can derive cost effectiveness. Presume a reduced trip saves at least operating and maintenance costs at \$0.30 per mile. Then the savings of 378 miles daily represents \$2,268 per month and \$27,216 per year. The investment in variable work hours is worthwhile the payback in savings accrues in a reasonable amount of time. The payback point is when the present value of one time and ongoing costs equals the present value of ongoing savings in vehicle operating costs. Using the hypothetical costs and savings and presuming a 10 percent discount rate, the program pays for itself in a little over six years.

#### IV. FUTURE DIRECTIONS

Experience with variable work hours suggest it can be an effective strategy for reducing commuter traffic especially in peak periods. However, each particular work hour technique warrants careful planning, assessment and evaluation in future applications. Specific effectiveness and implementation issues deserve attention in future applications:

##### Effectiveness

*Compressed Work Weeks:* This form of variable work hours appears very promising for reducing vehicle trips while maintaining or boosting use of transit and ridesharing. To date, the best documented case studies of compressed work weeks have been in the government sector. More private sector implementation should be encouraged in the future, along with evaluation of participation rates, assessments of best markets and evaluations documenting travel impacts.

- What types of employers and employees present the best prospects for wide adoption of the strategy?

- What participation rates can be expected in various industries and labor markets?
- What is the most popular type of compressed work week schedule in various types of industries and businesses?
- What changes can be expected in the timing and volume of trips, and mode of travel?

*Flextime:* This strategy appears to reduce travel in peak periods, but the effect on mode of travel is mixed. More testing and evaluation aimed at mode choice is encouraged.

- How much reduction in peak period travel can be expected?
- What travel time savings might result?
- Under what conditions does flextime support ridesharing and when might it conflict with ridesharing?

*Staggered Hours:* Very few staggered hour programs have been implemented as demand management efforts. Consequently, comprehensive evaluations of travel impacts would be most welcome.

- What are reductions in peak period travel?
- What level of participation among employers is needed to benefit not only program participants but all travelers in congested corridors?
- What are effects on carpooling and transit use?

##### Implementation

Variable work hours raise several implementation issues best addressed by feasibility assessments and detailed planning.

- What is the status of state labor policy for work in excess of 40 hours? If policy requires extra compensation for excess hours, what modifications or exceptions to the policy might be



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made to encourage variable work hours while preserving labor protections inherent in state legislation?

- What labor union agreements restrict employee hours and what changes are feasible and useful to encouraging variable work hours?
- What assurances and evidence does management need to overcome uncertainty or resistance to flextime?
- Under what local conditions are voluntary or regulatory or regulatory means preferred to encourage variable work hours?



## Footnotes

- <sup>1</sup> "Transportation Related Impacts of Compressed Workweek: The Denver Experiment," Terry Atherton, et. al., *Transportation Research Record* No. 845, 1982.
- <sup>2</sup> *Off Work Early*, by David Jones, Institute of Transportation Studies, UC Berkeley, February, 1983; also, "Flex-Time: A Voluntary Approach," *ITS Review*, Vol 6, No. 2, February, 1983.
- <sup>3</sup> *Bishop Ranch 1990 Transportation Survey*, Steve Beroldo, Rides for the Bay Area, December 1990.
- <sup>4</sup> "Staggered Work hours for Traffic Management: A Case Study," Genevieve Giuliano, Thomas Golob, paper before the 69th meeting the the Transportation Research Board, January, 1990.
- <sup>5</sup> "The Effects of Variable Work Hour Programs on Ridesharing and Organizational Effectiveness, A Case Study: The County of Ventura," Alyssa Freas, Stuart Anderson, a paper before the Transportation Research Board, January 1991.
- <sup>6</sup> David Burch, *1988 Database Survey, RIDES For Bay Area Commuters, Inc., San Francisco, California*, December 1988.
- <sup>7</sup> Behavioral Impacts of Flexible Working Hours, M. Ott, H. Slavin, *Transportation Research Record*, NO. 767, 1980.
- <sup>8</sup> Robert Cervero, *America's Suburban Centers - A Study of the Land Use Transportation Link*, January 1988, Op. Cit., p. 128.
- <sup>9</sup> Impact of Flexitime on an Employer-Based Rideshare Program, Case Study of the Tennessee Valley Authority, Knoxville, Tennessee, Frederick J. Wegmann, Stanely Stokey, Paper presented before the 1980 Transportation Research Board Meeting.
- <sup>10</sup> *Descriptive Summary of the Bus Express Employee Program: Demonstration of Employment Center Bus Service*, Southern California Rapid Transit District, September, 1980.
- <sup>11</sup> *Off Work Early, Volume II, A Guide to Implementation*, David W. Jones, Institute of Transportation Studies, February, 1983.
- <sup>12</sup> City of Pleasanton, *Information Report*, February, 1990.
- <sup>13</sup> Anis Tannir, *The Impacts of Feasible Staggered Work Hours and Compressed Work Week Policies on Highway Networks, Transportation Economics, Organizations and Employees*, New York State Department of Transportation, August, 1977.
- <sup>14</sup> State Transportation Agency Use of Non-Traditional Work Schedules, V.W. Korf, R. Pauley, *Transportation Research News*, No. 95, 1981.
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- <sup>16</sup> O'Malley, B. and C.S. Selinger, "Staggered Work Hours in Manhattan," *Traffic Engineering and Control*, Volume 14, No. 9, January, 1973.